JSDC
Journal of Studies in Dynamics and Change (JSDC);
Vol-10, Issue-1, ISSN: 2348-7038
www.jsdconline.com

Variation in Market Arrivals and its Effect on Potato Prices in Various Markets in Odisha

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ABSTRACT

For providing basic dietary nutrition, horticultural crop plays an important role. Although the area under horticulture and production increased over years, the price variability of some valuable crops like potatoes leads to create negligible confidence among farmers. So, the paper tries to find the actual behaviour of price and quantity of market arrivals of potatoes from the year 2010 to 2020. During the study period, the arrivals of products to the market show a negative growth rate over the months due to a lack of storage facilities, but prices show positive growth over the months. Seasonal indices show that the price behaves inversely to the quantity of arrivals over months. But the responsiveness of price to quantity is very negligible due to the perishable nature of potato crops. It is also found that the sample markets are not highly integrated up to the mark which makes a competitive environment.

Keywords: Arrival fluctuations, Potato prices, Odisha markets

JEL Classification Codes: Q13

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I. INTRODUCTION

To bring an economy towards the path of sustainable development, socio-economic development is a must which includes the improvement in food, livelihood, nutritional security, health, etc. For providing basic nutrition to humans and preventing them from diseases horticultural crops play an important role in contributing to the nation's development and prosperity (Agarwal, *et al.* 2018). Therefore, agricultural diversification should focus on these specific high-value crops given the significance of horticultural crops for an economy like India (Kumar, *et al.* 2005).

Suggested Citation:
Sahoo, P. K., & Mishra, S. P. (2023). Variation in Market Arrivals and its Effect on Potato Prices in Various Markets in Odisha. *Journal of Studies in Dynamics and Change (JSDC), 10*(1), 27-39
DOI: https://doi.org/10.5281/zenodo.10967540
Published on: 01 January 2023

The area used for horticulture increased by 2.6% annually and production rose by 4.8% over the previous ten years. Vegetable cultivation in India increased from 6.74 million hectares to 10.26 million hectares and production from 101.2 million tonnes to 184.40 million tonnes between 2004–05 and 2017–18. In Odisha, vegetable output climbed from 2.14 million tonnes to 2.40 million tonnes between 2013–14 and 2017–18, with a corresponding increase in the area under production from 325.86 thousand hectares to 340.48 thousand hectares (Horticultural Statistics at a Glance, 2018).

Potato is one of the major constituents of the daily diet in Odisha and its annual requirement is 10.21 lakh tonnes. But it produces only 2.5 lakh tonnes from 15 thousand hectares of cultivated area annually. The productivity of potatoes in Odisha is 16.48 tonnes/ha, which is below the national average of 22.76 tonnes/ha. So, most of the State's potato needs are met by imports from neighbouring states like West Bengal.

To improve the productivity of potatoes the marketing aspect must be focused. In an efficient agricultural marketing system, farmers can dispose of their produce at a fair and remunerative price (Majhi, 2021). Yet, the fluctuation in farm product prices has a negative impact on farmers' income, which then has an impact on the stability of farm investments and the productivity of the crops.

The supply and demand situation for agricultural commodities characterised by the seasonality of production and marketing causes price fluctuations. As a perishable horticultural product, potatoes are produced only during certain seasons. These factors cause the price of potatoes to fluctuate from month to month (Horticultural Statistics at a Glance 2018). So, it is challenging for both consumers with relatively inelastic demand for potatoes and producers, particularly small and marginal farmers with a low propensity to hold and limited access to effective warehousing. (Bera *et al.,* 2017).

Studies on price and arrival behaviour can assist policymakers in developing best-fit agricultural policies to control price volatilities and providing farmers with an opportunity to make well-informed decisions about adjustments to cropping patterns and disposing of product at the best place and the best time for a profitable price (Agarwal *et al.* 2018).

II. THE REVIEW OF LITERATURE

Trend Analysis

The ability to access market intelligence on a variety of topics, such as potential markets, quantity acquired, and present and projected prices in various regions during various periods is vital for avoiding many market-related issues (Kanungo, 2015). By considering an agricultural product like vegetables, the trend analysis of the market for arrivals and prices of different commodities revealed that the variation in the prices of vegetables in peak and the lean season was not significant because of the climatic condition required for the product like the supply of water required. This situation became aggravated due to the farmers' expectations about

the next harvest because of climatic conditions (Sharma and Singh, 2014). Such pricing trends may increase as a result of an increase in demand brought on by an increase in population, income, storing, processing, and a decrease in supply as a result of cold storage and marketing facilities, production methods, and market entrants over an extended period of time. (Bera *et al.* 2017).

Regarding the arrival components, inadequate storage and the distressed sale of food at neighbourhood markets may have contributed to a downward trend in market arrivals. (Bera *et al.* 2017). It was also found that the variability in the prices was low due to the lack of response of arrivals on prices and incompatibility in the marketing system for self-adjustment. So, it could be assumed that due to the perishability of the product, irrespective of price the arrivals might be high (Agarwal, *et al.* 2018).

Seasonal Variation Study

The seasonal indices for arrival were high in the peak season and low in the lean season because of two reasons, the seasonal nature of production and the farmers could not store the production to prevent such variation. For price opposite result was found, by which we derived a negative association between prices and arrivals (Chaudhary, *et al.* 2019).

Prices and Arrivals Relationship

The small, marginal, and tenant farmers, who have little bargaining power and very low retention power, were accused for the negative link between pricing and arrivals, which led to the distressed sale. Again, a positive and significant correlation coefficient could be attributed to the off-season supplies of these vegetables which catch the higher prices (Kumar *et al.* 2005 & Sharma and Singh, 2014).

Market Integration

Since their levels of integration vary, different markets have different degrees of efficiency. The extent to which prices of a commodity move together over some time in different markets located at varied distances from each other is an indicator of market integration for a commodity. A positive and high correlation coefficient between the prices of different markets means that the market is an integrated market and higher market competition is found there (Sharma and Singh 2014). A good integration might not be found because of the perishability of the products (Chaudhary, *et al.* 2019).

Research Gap

From the above-discussed studies, it was found that the current price and lagged price affects the market arrivals of agricultural products. But in the study region how both the prices affect arrivals is not explored yet. Also, there is no clear picture of the market integration, especially in the case of potatos production and marketing in Odisha.

III. DATA AND METHODS

Objectives

- To examine the patterns and variation in market arrivals and potato pricing in a few chosen Odisha markets
- To examine how market arrivals and pricing vary seasonally
- To investigate the relationship between market arrivals and both the current and lagging pricing for potatoes
- To show the market integration

Description of the Selection of Markets

Considering the importance of analysis regarding potato production in Odisha, five major potato producing districts are selected namely Koraput, Cuttack, Balasore, Jagatsinghpur, Angul, Kendrapada, Puri and Mayurbhanj, because the value of the output of potato production in these districts shares 65.73% of the total value of potato in the State (Directorate of Economics and Statistics, Odisha, 2020) There are 138 market yards (www.agmarknet.gov.in) in the selected district out of which 5 markets namely Banki, Betnoti, Jaleswar, Jeypore and Nimapada are selected randomly.

Nature and Source of Data

For the analysis secondary data have been collected daily for arrivals and prices from 2010 to 2020. The arrivals statistics in a market refer to the total arrivals over the course of each market occurrence in quintals. The modal prices for each era have been taken in order to provide price data. The largest share of the commodity that is sold every day in a specific market is represented by the modal price, which is preferred over the average price.

Analytical Methods and Instruments

In time series analysis, a Fourier analysis was employed to pinpoint the variations in the values caused by trends, cycles, and any irregular short-term variations. Here, the trend change could be brought on by population expansion, shifting consumer tastes, agricultural technology advancements, etc. Customs, climates, and other factors are some potential causes of seasonal fluctuations. Long-term variations known as cyclical variations depend on business cycles. The impact of irregular variables is random and utterly unpredictable (Patel and Patel, 2013).

To show the growth rate, the Compound Annual Growth Rate procedure has been used (Agarwal, et al. 2018). Trend analysis has been conducted by using the mean and coefficient of variation analysis (Kumar, et al.2005, Sharma and Singh 2014 & Singh, et al.2017). Seasonal indices are calculated by the use of 12 monthly moving averages (Sharma and Singh 2014 & Singh, et al.2017). The relationship between current arrivals, current prices and one-time period lagged prices has been done by using the regression model:

$$Y = f(P_t , P_{t-1})$$

Where,

P = present price at time t
P = lagged price at time t-1
Y = present arrival

The market integration is studied by making a correlation analysis between the price of potatoes in different selected markets (Patel and Patel, 2013, Sharma and Singh, 2014 & Chaudhary, et al, 2019).

IV. ANALYSIS AND RESULTS

Growth Rate

The compound annual growth rate of market arrivals and prices of potatoes during the study period is presented in Tables 1 and table 2 respectively.

In the case of arrivals of products to the market, a higher negative growth rate was found except for Jeypore over the year. This is due to Koraput being the highest contributor to the production of potatoes in 2015-16 (Directorate of Economics and Statistics, Odisha, 2020). Such a decline in arrivals is due to a lack of storage facilities at the village level as well as sufficient at the market level (Bera, *et al.* 2017).

Table-1: Compound Annual Growth Rates of Arrivals from 2010 to 2020 (in Percentage)

Month	Banki	Betnoti	Jaleswar	Jeypore	Nimapada
January	-13.48	-46.95	11.74	12.30	-21.83
February	-12.17	-19.98	14.50	8.48	-21.31
March	-15.34	-18.16	12.80	29	-24.32
April	-12.17	-18.41	16.18	16.39	-21.19
May	-12.26	-11.20	14.80	22.09	-21.44
June	-8.60	-12.14	11.47	1.96	-22.92
July	-3.07	-17.89	5.31	1.88	-22.47
August	8.14	-24.03	4.55	8.27	-21.46
September	-1.52	-24.07	8.68	11.98	-20.93
October	2.72	-22.35	-2.18	7.20	-22.62
November	14.17	-22.26	-8.62	4.31	-15.71
December	11.42	-21.77	-4.22	4.35	-2.65

Source: Authors' compilation

The prices of potatoes grow positively over the months across the years in all study areas. The growth rate was relatively higher during August, September and October because these are the pre-harvesting period in Odisha (Directorate of Economics and Statistics, Odisha, 2020).

Trend Analysis

Trend analysis is done through the study of variability over the years. The variability in arrivals and prices of potatoes from the year 2010 to 2020 is analysed and depicted in Table 3. The calculation of mean and coefficient of variation shows

the magnitude and direction of change of market arrivals and prices in the study area over the period. Results revealed that the market arrival is highest in the year 2019 with a mean of 5776.97 tonnes and lowest in the year 2017 (3165.08 tonnes). However, there had been inter-year variations during the period under study. The variation is highest in the year 2018 (200.32%) because of the origin of a sizeable hike in the prices in 2017. But there is not much variation in the prices over the years ranging from 9.02% to 26.25%.

Table-2: Compound Annual Growth Rates of Prices from 2010 to 2020 (in Percentage)

Month	Banki	Betnoti	Jaleswar	Jeypore	Nimapada
January	0.05	10.39	11.47	9.45	1.72
February	11.91	11.1	11.19	-1.4	10.87
March	65.71	13.4	14.57	0.85	13.68
April	13.52	15.05	15.9	5.72	11.57
May	13.78	16.95	14.74	5.58	12.65
June	10.28	12.83	11.27	1.47	11.45
July	11.27	12.67	11.19	4.4	15.14
August	12.09	13.66	13.25	4.62	17.09
September	13.15	17.97	14.17	3.46	17.31
October	13.12	18.34	15.52	3.75	15.18
November	12.02	15.79	12.34	3.72	13.97
December	15	17.17	15.26	3.24	15.84

Source: Author's compilation

Table-3: Yearly Variability in Arrivals and Prices of Potatoes during 2010-2020

Year	Arrivals		Prices	
	Mean	CV(%)	Mean	CV(%)
2010	5431.25	79.07	702.74	29
2011	6401.6	91.7	818.53	24.72
2012	5621.69	83.18	1151.9	12.54
2013	5021.05	71.65	1272.8	18.69
2014	4323.19	104.48	1896.09	12.93
2015	3703.98	160.63	1004.07	26.25
2016	3475.38	148.96	1544.2	9.02
2017	3165.08	159.33	1076.09	25.33
2018	4659.04	200.32	1290.46	16.35
2019	5776.97	182.01	1297.42	16.56
2020	3791.96	155.4	2324.62	23.22

Source: Author's compilation

Table-4 shows the uncertainty in monthly market arrivals of potatoes in different markets from 2010 to 2020. In Banki, the market arrival variability ranged from

46.06 in December to 95.66 in June and the average amount received also vary from the lowest of 44.85 quintals in December to the highest of 128.65 quintals in June. The Betnoti market has registered a market arrival variability range from112.69 in March to 166.44 in August but the average amount received ranged from 256.16 quintals in June to 594.61 quintals in January. In the Jaleswar market the average amount of Potato received is lowest in November and highest in May whereas the market arrival variability ranged from 50.18 in June to 84.35 in November. The market arrival variability is comparatively low in the Jeypore market as compared to Nimapada. Here, irrespective of Banki, all other markets revealed that variability in market arrivals of potatoes from June to November is high due to the peak harvesting season in the State.

Table-4: Unpredictability in Monthly Market Arrivals of Potato in Different Markets from 2010 to 2020 (Mean in Quintals, CV in Percentage)

	Banki		Betnoti		Jaleswar		Jeypore		Nimapada	
Mon	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Jan	82.8	73.5	594.6	121.3	1009.4	69.8	146.5	57.9	342.4	103.8
Feb	68.7	65.3	511.4	117.7	905.6	69.7	162.4	63.4	264.8	110.8
Mar	96.1	93.3	553.2	112.7	1103.3	57.5	160.4	73.4	345	103.9
Apr	104.8	83.4	444.2	114.9	987.2	62.7	180.3	64.3	323	105.3
May	107.7	74.1	422.4	126.3	1110.8	69.1	249.3	84.2	271.3	112.6
Jun	128.7	95.7	256.2	119.7	959.9	50.2	108.9	69.2	303.3	108
Jul	105.5	80.9	371.8	139.6	1091.4	73.2	185.3	47.1	302.3	111.9
Aug	84.7	97.5	312.7	166.4	1190.6	75.2	203	53.8	268.4	122.4
Sep	77.7	73.0	274.4	144.7	929.4	77.5	177.6	76.8	264.2	121.5
Oct	69.5	70.2	298.8	142.3	890.6	79.8	162.4	54.9	248.9	117.8
Nov	55.2	65.2	330.4	149.6	869.7	84.4	202.6	63.2	222.8	129.4
Dec	44.9	46.1	471.9	146.3	964.8	81.1	175.8	72.6	199.4	140

Source: Author's compilation

Coming to the prices aspect, the variability in monthly market arrivals for the different markets is given in Table-5. For prices, the variability is also high in the post-harvesting period. In the Jeypore market, the price variability is comparatively low because most of the products are transacted in organised markets, where the easier availability of market information helps the cultivators to adjust their supply according to the demand. But in the case of Nimapada and Betnoti, the price variability is relatively high. Here again, the mean prices of Jaleswar and Jeypore are relatively high may be due to the formal and informal transactions.

Seasonality in Market Arrivals and Prices of Potato

Seasonal indices for arrivals are computed to determine the long-term seasonal fluctuation in the arrivals of potatoes in the chosen markets. Table-6 displays the seasonal indices of monthly arrivals of the chosen marketplaces. The outcome suggests that potatoes arrive in all markets according to a seasonal pattern. In the study markets, the higher market arrival indices (greater than 100) are noticeable

from March to July. This is because of the off-season arrival from different regions to the study markets.

Table-5: Variability in Monthly Market Prices of Potato in Selected Markets from 2010 to 2020 (Mean in Quintals, CV in Percentage)

	Banki		Betnoti		Jaleswar		Jeypore		Nimapada	
Mon	Mean	CV	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Jan	279.9	42.7	241.5	56	871.1	58.7	1404.3	31	343.2	55.5
Feb	252.4	53.7	222.3	53.2	773.1	55.3	1149.5	47.2	301.9	46.7
Mar	289.2	43.4	254.3	48.6	806.8	54.5	1240	25.9	318.5	39
Apr	262.8	37.4	237.5	46.9	984.9	45.3	1204.8	18.8	327.1	39.2
May	280	33.4	259.7	37.9	1168.8	33.6	1303.4	18.2	360.8	37.2
Jun	230.1	35.5	220.5	41.3	1281.5	45.5	1525.9	19.5	389.8	42.3
Jul	267.1	38.3	250.7	44.7	1225.9	50.4	1676.8	23.1	409.9	49.9
Aug	276.7	44.1	266.7	51.4	1240.2	54	1549.6	30.4	403.9	49.9
Sep	237.7	50.7	231.1	57.6	1317.8	51.7	1592.2	35.7	410.7	52
Oct	229.5	46.8	219.2	56.2	1364	48.1	1645.9	28.7	417.4	51.2
Nov	235.2	52.7	223.3	61.2	1419.4	60	1640.6	30.5	428	60.8
Dec	255.3	39.1	230.5	50.8	1152	53.3	1521.1	32.8	386.1	50.6

Source: Authors' compilation

Table-6: Seasonal Indices of Arrivals of Potato in Different Markets (in Percentage)

Months	Banki	Betnoti	Jaleswar	Jeypore	Nimapada
January	102.52	42.2	102.34	82.95	121.36
February	89.46	22.99	93.34	91.54	100.05
March	114.77	34.48	116.01	91.32	118.57
April	113.08	26.56	96.74	99.65	112.3
May	119.79	31.83	111.81	126.07	97.65
June	132.35	37.75	99.47	68.97	108.95
July	113.85	30.51	107.49	115.31	102.09
August	96.82	41.27	113.78	113.16	90.09
September	86.75	34.09	90.16	94.07	90.19
October	81.21	28.37	85.45	96.97	90.8
November	78.32	37.64	83.6	120.12	84.49
December	71.07	39.63	99.81	99.85	83.47

Source: Authors' compilation

The seasonal indices of monthly prices of potatoes in the selected markets are presented in Table-7. It can be found that the prices are high during the months when the arrivals are low and are low during the months of high arrivals in most cases. The higher seasonal price indices observed in Banki are in the months from July to December and in Jaleswar from May to December. Here the large seasonal indices show stability during the remaining months of the year during the study period.

Table-7: Seasonal Indices of Prices of Potato in Different Markets (in Percentage)

Months	Banki	Betnoti	Jaleswar	Jeypore	Nimapada
January	89.9	89.48	81.02	97.98	86.61
February	68.98	65.65	69.66	78.95	69.38
March	75.53	69.73	70.04	85.57	73.6
April	81.79	83.26	86.49	83.55	81.12
May	94.89	98.8	106.42	90.71	99.93
June	100.25	104.78	112.48	106.07	103.8
July	105.45	110.56	106.31	116.07	108.69
August	107.5	109.53	106.54	105.97	108.26
September	111.01	112.42	115.85	107.93	109.42
October	118.9	114.65	119.91	112.1	114.63
November	133.06	127.4	122.56	111.38	135.2
December	112.74	113.74	102.71	103.73	109.35

Source: Author's compilation

In Figure-1, we have a comparative analysis of seasonal indices of both price and quantity. Here all the markets show a long-run seasonal variation. But except Betnoti, other markets show an inverse association between the variation in the market arrivals and prices. In the case of Betnoti, the seasonal variability of quantity arrivals is very low throughout the year which may be for the perishability of products and a major chunk of production being sold to intermediaries at the firm level.

Market Arrivals and Price Relationships

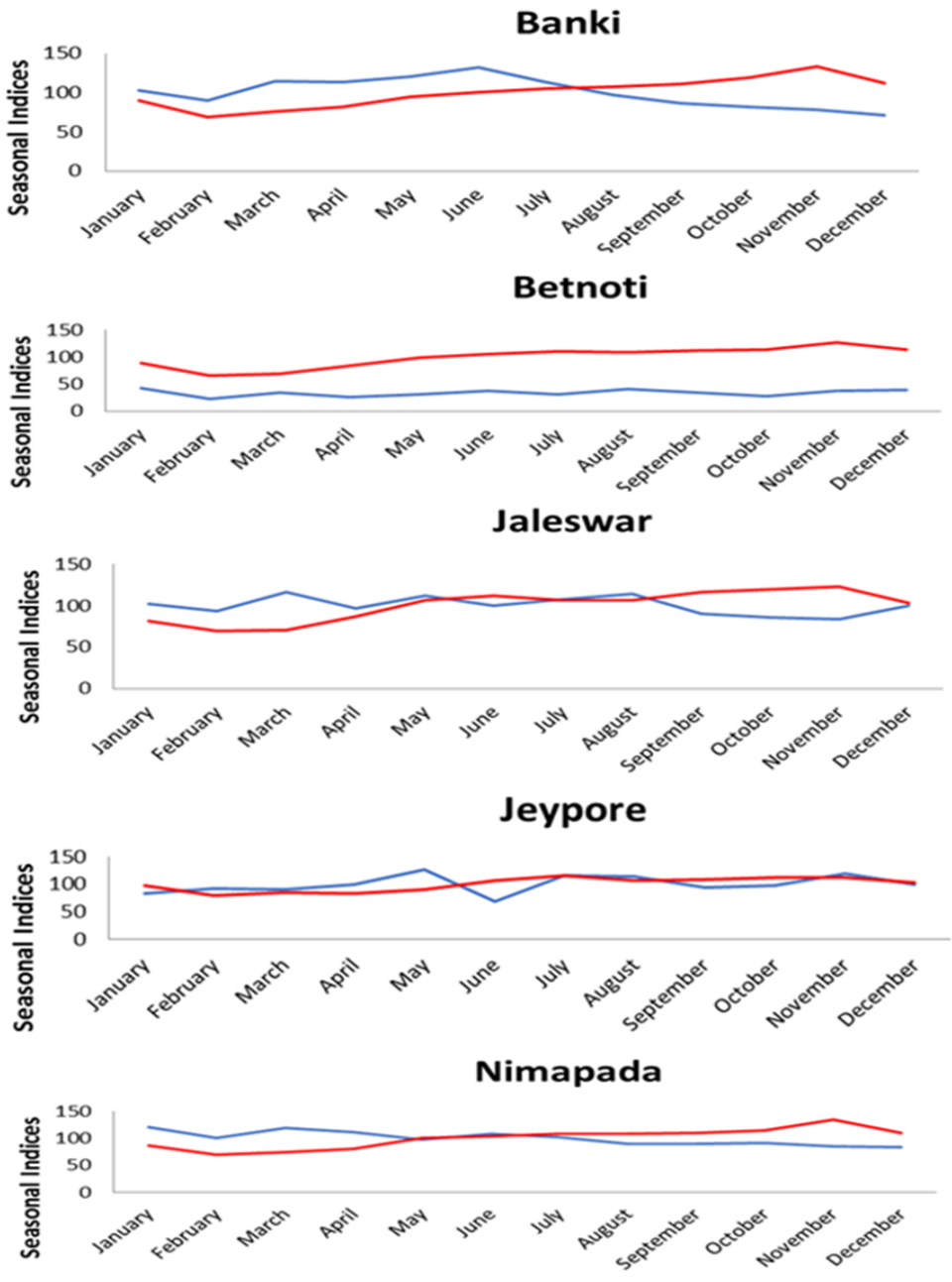
It is common knowledge that prices and market arrivals have an inverse relationship and that prices and lagged prices have a positive association. Yet, factors like the accessibility of cold storage facilities, improved export options, value addition through agro-processing, accessibility to modern poly house technology, etc. not only diminish but even reverse such relationships.

Table-8 showing the lower R- square values reflects that the variation in the arrivals is mostly affected by the non-price elements in the market yards and very negligibly influenced by the price factors. In Nimapada 24.5% of total arrivals are affected by the current price and lagged the highest price. But, for other market yards under study, more importance should be given to infrastructural facilities and other marketing facilities, so that the market arrival and prices can be auto-adjusted through demand and supply. This will give more incentive to farmers to produce potatoes according to the market requirement.

The low R-square during the study period is a result of the marketing system's inability to support self-adjustment as well as the lack of pricing reaction to

arrivals. So, it can be assumed that due to the perishability of the product irrespective of price, the arrivals are high (Agarwal, *et al.* 2018).

Figure-1: Comparative Analysis of Seasonal Indices



Source: Author's compilation

Table-8: Regression between Market Arrivals, Current Prices and Lagged Prices

	Banki	**Betnoti**	**Jaleswar**	**Jeypore**	**Nimapada**
R Square	0.06	0.15	0.01	0.06	0.25
Coeff. of the current price (sig.)	0.16(.41)	-0.23(.22)	0.18(.36)	-0.08(.67)	-0.28(.070)
Coeff. of lagged price (sig.)	-0.37(.05)	-0.17(.38)	-0.2(.32)	0.3(.11)	-0.23(.128)

Source: Author's compilation by using SPSS

Market integration

From Table-9, it is found that there is very negligible market integration of Banki with other markets with a correlation coefficient of less than 0.25 for all markets. But, the rest of the markets show more integration with higher positive correlation values which are statistically significant also. This integration may be attributed to the initiatives taken by the government for regulation of the market and proper dissemination of information. Such information helps both the farmers and consumers to adjust their respective supply and demand. This will lead the market towards a competitive one.

Table-9: Correlation Coefficient Test between Prices

	Price of Banki	**Price of Betnoti**	**Price of Jaleswar**	**Price of Jeypore**	**Price of Nimapada**
Price of Banki	1	.230*	-0.032	0.175	.237**
Price of Betnoti	.230*	1	.840**	.732**	.961**
Price of Jaleswar	-0.032	.840**	1	.484**	.823**
Price of Jeypore	0.175	.732**	.484**	1	.663**
Price of Nimapada	.237**	.961**	.823**	.663**	1

* At the 0.05 level, correlation is significant
** At the 0.01 level, correlation is significant
Source: Author's compilation by using SPSS

V. CONCLSION

From the above analysis, it can be concluded that the negative growth rate in arrivals is due to the higher availability of the local market at the farm level. So, the distance of the market affects most of the arrivals. But, positive growth in price arises due to the dissemination of market information. Farmers' poor negotiation power and extremely low retention power are to blame for the weaker correlation between price and arrivals. Once more, because there are numerous vegetable crops with the same harvesting season, the substitutability or complementarity of one vegetable impacts the price of the others.

Recommendations

To reduce the price variability, the market should be organised one which disseminates the marketing knowledge among the cultivators to adjust their supply according to the demand.

Limitations of the Study

One of the main drawbacks of this research is that it just took the potato into account for the analysis. Also, location-wise, this is restricted only to five markets (Banki, Betnoti, Jaleswar, Jeypore and Nimapada). Further studies on various crops around Odisha can be done.

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